We learn from the Annual Report of the Moscow University that the number of students at the University was, during 1878, 1,643, with 108 professors; 318 of them were in the Jurisprudence Faculty, 131 in the Philological, 240 in the Physico-Mathematical, and 954 studied Medicine. No less than 62 medical students have taken part in the last war; the majority of students are very poor, and 417 of them received pecuniary help which has reached, during the year, the sum of 11,500*l.*

SCIENTIFIC SERIALS

American Journal of Science and Arts, January, 1879.—Prof. Loomis's important paper in this number on storms on the Atlantic, &c., has been noticed elsewhere. Prof. Marsh (in an appendix) describes a new order of extinct reptiles (*Sauranodonta*) from the Jurassic formation of the Rocky Mountains; they closely resemble Ichthyosaurus (of which no remains have hitherto been found in America), but are without teeth. The same author continues his "Principal Characters of American Jurassic Dinosaurs."—Prof. Greene, of Troy, New York, describes a paper dome constructed from his plans for an astronomical observatory. The paper covering is in sixteen equal sections, the framework of each section consisting of three ribs of pine meeting at the apex. There are also a circular sill at the base and two parallel semicircular arch girders spanning the dome (all of pine). The entire structure weighs about 4,000 lbs. The dome is supported on six 8-inch balls rolling between grooved iron tracks by direct pressure.—Mr. Edison describes his tasimeter as applied to measuring the heat of the stars and of the sun's corona.—Mr. Fontaine writes on the mesozoic strata of Virginia, and Mr. Holden on the brightness and stellar magnitude of the third Saturnian satellite.—A list of fifty species of east coast fishes (many of them new to the fauna) is supplied by Messrs. Goode and Blan.—In the "Miscellaneous Intelligence" will be found the report of the committee appointed to consider the scientific surveys of the United States territories.

SOCIETIES AND ACADEMIES

London

Royal Society, January 23.—"On the Microrheometer." By J. B. Hannay, F.R.S.E., F.C.S., lately Assistant Lecturer on Chemistry in the Owens College, Manchester. Communicated by H. E. Roscoe, LL.D., F.R.S., Professor of Chemistry in Owens College, Manchester.

In this paper the author reviews the work done by chemists and physicists in determining the relation between the chemical composition of a liquid and its rate of flow through a capillary tube. Poiseiulle[1] ascertained, in a very accurate manner, all the physical laws relating to the rate of flow, as regulated by temperature, pressure, and dimensions of the tube; but on examining saline solutions he could make nothing of the numbers presented, because he used percentage solutions instead of solutions proportional to the equivalent of the body dissolved. Graham,[2] noticing that Poiseiulle had discovered a hydrate of alcohol by running various mixtures of alcohol and water through the tube, examined mixtures of the various acids with water, and found that the hydration proceeded by distinct steps of multiple proportions. Several others, notably Guerout,[3] have since worked on the same subject, but as they have only worked on organic liquids, and have done all the rates at the same temperature, the results throw no light on the phenomena. Thus water runs about five times as quickly at 100° as at 0°; and in a series of alcohols, such as Guerout experimented upon, the differences between their boiling points were very great, so that, their vapour tensions or molecular mobilities being quite incomparable while at the same temperature, the experiments do not admit of any real interpretation. The author reserves the organic part of the investigation, which requires the determination of vapour tensions, till a future paper, and in the present deals with saline solutions.

The phenomenon of the flow of liquids through capillary tubes has been called in this country transpiration, while in other countries no distinct name has been adopted; and as the English word is already in use in French for another purpose, and properly applies to gases (the laws relating to which are quite different), the author proposes to use for liquids the term "Microrheosis," from μικρός and ῥέω, the instrument being called the microrheometer. The form of apparatus which the author finally adopted is figured in the paper, and is so arranged that when the liquid is introduced, as many experiments as may be desired may be tried, and the pressure and temperature, as well as the atmosphere in which the experiment is conducted, may be varied, while the thermometer indicating the temperature is at the mean point of the system. The author gives a curve for water from 0° to 100°, the differences of rate being smaller as the temperature rises.

Various salts are then examined, being dissolved to form "normal" solutions; but as the solubility of some salts is too low for such solutions, the effect of the amount of salts dissolved is determined. This is found to be directly proportional to the amount of salt in solution. Values for many salts in solution are then given, each number being the mean of ten experiments, and the probable error of the mean is calculated in each case. The conclusions arrived at are these. The rate of flow does not depend on any of the "mechanical" features of the salt, such as crystalline form, specific volume, solubility, &c.; but upon the mass of the elements forming the substance and the amount of energy expended in its formation. Each element has a value of its own, which is continued in all its compounds. Thus all the salts of potassium and sodium formed by the same acids have a constant difference. In like manner each metalloid and acid radicle has a value which is continued in all its combinations. Then the greater the combining value of an element the quicker is its microrheosis; thus potassium has a higher rate than sodium, barium than strontium, strontium than calcium, and so on. The microrheosis also varies with the amount of energy in the compound; thus nitrates stand highest, as they contain most energy; then chlorides; and, lastly, sulphates, which are exhausted compounds.

The instrument, bringing to light as it does the fundamental relations of combining weight and energy in chemical action, will be of the utmost importance in chemical physics, as by its use not only will the amount of energy evolved in reactions be determined, but the mass combined; or, in other words, the chemical equivalent of the elements involved will be found.

February 6.—"On certain Dimensional Properties of Matter in the Gaseous State." By Osborne Reynolds, F.R.S., Professor of Engineering at Owens College.

Mathematical Society, February 13.—C. W. Merrifield, F.R.S., president, in the chair.—Sir J. Cockle, F.R.S., was admitted into the Society.—Mr. R. Hargreaves and Prof. W. E. Story were proposed for election.—Dr. Hirst, F.R.S., communicated a paper by M. Halphen on the number of conics which satisfy five independent conditions.—Sir J. Cockle spoke upon a construction for making magic squares. Messrs. Cayley, Harley, Henrici, Roberts, Hart, and other gentlemen took part in a discussion on the subject. Prof. Henrici, F.R.S., gave some properties of frames.—Prof. H. J. S. Smith, F.R.S., read two papers on a modular equation and on the formula for four Abelian functions.—Mr. J. J. Walker communicated a quaternion proof of Minding's theorem.

Linnean Society, February 6.—Prof. Allman, F.R.S., president, in the chair.—Mr. J. R. Jackson exhibited specimens from the tombs of ancient Thebes. Among these were fruits of the Doum Palm (*Hyphæne thebaica*) and of *H. aigun*, formerly, but wrongly, described as an *Areca*. Small berries also obtained were identified as those of *Juniperus phœnicea* as against those of *J. excelsa*.—Mr. J. G. Baker showed dried bulbs of *Buphane toxicarea*, which furnish a principal ingredient of the poison the Bushmen of South Africa tip their arrows with. Structurally, the numerous tunics of the bulb are a peculiarity. The range of this plant has been found to be as far north as Lake Tanganyika. In Sir C. W. Strickland's hothouse a plant flowered last year, and this for the first time in England.—Mr. W. T. Thiselton Dyer shortly described specimens of, and pointed out the special characters and probable advantages of, a new fodder grass, *Euchlæna luxurians*, and he also exhibited and made remarks on curious instruments used for weaving fibre of *Curculigo latifolia* by the natives of Borneo.—Mr. T. Christy drew attention to a sample of tea grown in Natal, and to a bottle of the milky secretion of the African Rubber Tree (*Landolphia*), the same having been freshly drawn from the living plant and immediately thereafter forwarded to this country; slight coagulation of the juice had nevertheless occurred.—The Rev. G. Henslow passed round for examination a specimen of female mistletoe bearing male shoots. The botanists present expressed opinion of its being an androgynous condition rather than a male parasitic on a female plant, as had been supposed.—Mr. R. Irwin Lynch exhibited and made remarks on parts of the Bull's Thorn Acacia (*A. sphærocephala*), the Imbauba Tree (*Cecropia peltata*), and on a couple of Orchids (viz., *Espidendron bicornutum*, and *Schomburghii tibicinus*), as exemplifying their economy in affording protection to, and food for, ants. Mr. F. Darwin has already described the two former (*L. S. J. Bot.*, xv. p. 398), but that orchids should furnish a nidus for ants is apparently a new fact.—A short paper on the position of the genus *Sequenzia* among the Gasteropoda was read by Dr. J. Gwyn Jeffreys. His opinion differs from that lately promulgated by the Rev. R. B. Watson, believing that it belongs to the Solarium group rather than to the Trochus family, where placed by the latter naturalist.—There followed two papers on the anatomy and on the habits of ants, the gist of which we give elsewhere.

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[1] *Ann. de Chim. et de Physique*, [3], t. vii. 50.

[2] *Phil Trans.*, 1861, p. 373.

[3] *Comptes Rendus*, lxxix. p. 1201; lxxxi, p. 1025.

Physical Society, February 8.—Annual meeting.—The President (Prof. W. G. Adams) read the Report of the Council, which showed that the papers had been more numerous during the past than in any previous year, and that their value and interest had been well sustained.—A copy of the collected papers of the late Sir Charles Wheatstone was laid on the table, and the work will shortly be issued to the members of the Society.—The President then gave a brief review of the physical work of the past year, dwelling more especially on the papers read at the meetings.—Votes of thanks were then passed to the president, to the Lords of the Committee of Council on Education, to the demonstrator, treasurer, secretaries, and auditors, and the following were elected as Council and Officers for the ensuing year:—President—Prof. W. G. Adams. Vice-Presidents—Prof. G. C. Foster, Prof. R. B. Clifton, Lord Rayleigh, Dr. Spottiswoode, Sir Wm. Thomson. Secretaries—Prof. A. W. Reinold, Mr. W. Chandler Roberts. Treasurer—Dr. E. Atkinson. Demonstrator—Prof. F. Guthrie. Other Members of Council—Capt. W. de W. Abney, Dr. Warren de la Rue, Major E. R. Festing, Prof. Fuller, Dr. Huggins, Prof. A. B. W. Kennedy, Prof. McLeod, The Earl of Rosse, Mr. G. Johnstone Stoney, Dr. Wormell. Honorary Members—Prof. G. R. Kirchhoff, Dr. J. Plateau.—The meeting was then resolved into an ordinary one, and Dr. O. J. Lodge read a short paper on a method of calculating the course of temperature in a rod along which heat is being conducted.—Mr. Shoolbred gave an account of electric lighting illustrated by diagrams of the most recent magneto- and dynamo-electric machines and examples of the lamps in vogue. The only surviving magneto-machine is that of De Meritens, which is incomparably superior to the older ones of Nollet and Holmes. The dynamo-electric machines described were the continuous-current machines of Siemens, Gramme, Wallace-Farmer, and the alternating current machines of Wilde, Gramme, and Lontin. Wilde's machine is the first of these, or parent machine, and Lontin's so resembles it that the latter cannot be used in England. In these machines the current from a continuous machine is passed through a second machine, which yields the alternating currents. In Lontin's machine also a number of distinct currents are generated in separate circuits, each of which is capable of feeding several lights. There is now one in use on the Western Railway of France which gives three distinct currents, each of which supplies four different lamps, making a total of twelve lights. The American Brush machine was also mentioned. The Dubosq lamp, which was the first regulator, is well adapted for laboratory purposes, but for practical purposes the Serrin is preferable. Rapieff's lamp is used in the *Times* office. The De Mersanne, which was highly spoken of at the Paris Exhibition, moves the carbons by bevelled gearing. The Wallace-Farmer lamp, though durable, is unsteady, perhaps because only inferior gas carbon has yet been used. Jablochkoff's candle was found to be defective from the solid insulator, such as plaster, used between the carbons. This made it very expensive also. Experiments in Paris had shown that whereas Jablochkoff's system cost 10*d.* per hour per light, the other systems only cost one half of that. In Wilde's candle the solid insulator was dispensed with, air taking its place, the arc always tending to keep at the tip of the candle by electro-dynamic repulsion. In the De Meritens' candle three strips of carbon were used, the intermediate one being a stepping-stone to the arc, which passes between the two outer ones. Werdermann's and Regnier's so-called incandescent lamps were also shown. Mr. Shoolbred, after alluding to the fact that the upper positive carbon takes a crater form, and hence becomes a reflector, shedding the light downwards, stated that experiments had proved the line of maximum intensity of light to pass downward at an angle of 60° to the axis of the vertical carbons. By giving the positive carbon a horizontal displacement behind the lower negative one, Mr. Douglass, of the Trinity House, had been able to raise this line till it became horizontal, an advantage in lighthouses. He also pointed out that whereas in Paris the Jablochkoff waxed for a period, short compared to that in which it waned, in London it waxed for longer than it waned, which was, of course, an improvement, and Mr. Shoolbred suggested that it might be due to the fact that the engine worked at speed nearer to that of the machine, and that the machine was founded more solidly in London than in Paris. Mr. Werdermann said that it was a mistake to call his lamp an incandescent one, the fact being that all carbon lamps gave light from the incandescence of the positive carbon, and that a small arc was formed in his lamp between the two electrodes, which could be varied by the pressure between them. He maintained that it was as easy to produce 500 lights as 10 from the electric current by subdivision, as he hoped soon to show; and stated that the size of the carbons greatly controlled the intensity of the light. Prof. Ayrton held that the obstacle to the subdivision of the electric light was not an electrical one, but was due to the fact that the amount of light produced by the current is not in direct proportion to the amount of the heat produced. In contradiction to Prof. Ayrton, Mr. Werdermann stated that in the electric arc the opposing electromotive force was proportional to the original electro-motive force. Prof. Silvanus P. Thomson pointed out that residual magnetism in the cores of the bobbins of dynamo-electric machines lowered their efficiency, and hence short cores, as in the Wallace-Farmer machine, were an improvement.

EDINBURGH

Royal Society, January 20.—Prof. Kelland, president, in the chair.—Prof. Crum Brown gave the third part of a paper by him and J. Adrian Blaikie, B.Sc., on the action of heat on salts of tri-methyl-sulphine. They find that—I. the aqueous solution of tri-methyl-sulphine does not yield crystals when evaporated over sulphuric acid in vacuo, but only a thick syrup was obtained. On heating this at 100° it decomposes—water acetate of methyl and sulphide of methyl being given off.

$$CH_3{-}COO{-}S(CH_3)_3 = CH_3{-}COO{-}CH_3 + (CH_3)_2S.$$

II. The aqueous solution of benzoate of tri-methyl-sulphine cystallises in small thin plates which it is difficult to separate from the thick mother-liquor. On heating, the imperfectly dried salt yields at 110° water, sulphide of methyl and benzoate of methyl; the later boiling at 198°.

$$C_6H_5{-}COO{-}S(CH_3)_3 = C_6H_5{-}COO{-}CH_3 + S(CH_3)_2.$$

III. The dithionate of tri-methyl-sulphine is obtained by neutralising free aqueous dithionic acid with the hydrate. It crystallises readily in small clear cubes with one molecule of water of crystallisation. It is not hygryscopic. On heating at 220° sulphurous acid begins to come off, and afterwards along with it sulphide of methyl, leaving methyl-sulphate of tri-methyl-sulphine.

$$\left\{(CH_3)_3S\right\}_2S_2O_6{-}H_2O = \left\{(CH_3)_3S\right\}CH_3SO_4 + SO_2 + S(CH_3)_2 + H_2O.$$

—Prof. Tait then gave the result of some experiments he had been making to determine the electro-motive force of the Gramme magneto-electric machine at different speeds. The experiments were not completed but they seemed to show that the electromotive force varied approximately in the duplicate ratio of the rate of turning. He explained that the Gramme machine with an electromotive power of about 37 Bunsen cells could give as powerful an electric light as a battery of 60 Bunsen cells, for the resistance in the Gramme is very much less than that in the battery of Bunsen.—Prof. Tait gave a note on the law of cooling of bars. He mentioned that in his continuation of the experiments of the late Principal Forbes on the condition of heat in bars, he had been able to reproduce all Forbes's results with one exception. This was that the rate of cooling of the bar when exposed after being heated to a high temperature, was found by Forbes to be rather slower at first than afterwards. Or if we express the temperature of the bar in terms of its excess of temperature above the air, he found that at first it grows till it reaches a maximum and then falls off. Prof. Tait found this phenomenon always at the beginning of his experiments, but by heating the bar to temperatures higher than was required for his experiments, this peculiarity vanished before the temperatures were reached upon which the results were based. On trying to explain this phenomenon by Fourier's conduction of heat, he found that the difference between the true and the false law of cooling should not last more than a fraction of a second, whereas it lasted more than 10 minutes. He accordingly concluded that it must be due to the fact that the thermometers did not acquire at once the temperature of the bar, but that some minutes must elapse before the whole of the thermometer has the proper temperature. He tested this by heating a bar and placing a thermometer in it as soon as it was allowed to cool. The phenomenon appeared. After a few minutes, when the thermometer was indicating the true rate of cooling of the bar, a second thermometer was placed in the bar close to the first. The second showed the same phenomena, though the first was now following the usual law of cooling. In 5 or 6 minutes the first and second thermometers gave identical results, but a third thermometer gave the old phenomenon when newly inserted alongside the others. Other experiments confirming these were also made.—Mr. J. Y. Buchanan read a note on the distribution of temperature under the ice in Linlithgow Loch. He had made these experiments while testing a new deep-sea thermometer by Negretti and Zambra. His results showed that with the depths for abscissæ and the corresponding temperatures for ordinates, the curve so plotted was one of contrary flexure—the contrary flexure being at the temperature of 37·6° F., which he expected further experiments would show was the temperature of maximum density for the water of the loch. One remarkable fact was that the temperature rose as the bottom was reached, being about 40·1° there. This he thought was due to the oxidation of matter at the foot, and this idea was confirmed by the fearful stench of the water.—Dr. Alexander Macfarlane continued his paper on the principles of the logical algebra. He showed that $x^2 = x$ is of the nature of a condition imposed on x and that a more general form is $x^2 = \pm x$. He applied the principles of the logical algebra to deduce the general conclusion from data of certain common forms, and gave theorems on the number and nature of such general conclusions.

PARIS

Academy of Sciences, February 10.—M. Daubrée in the chair.—The following papers were read:—Last reply to M. Pasteur, by M. Trecul.—Fourth reply to M. Berthelot, by M. Pasteur.—On the existence of an apparatus prehensive or complementary of adherence, in parasitic plants, by M. Chatin. This apparatus is most commonly furnished by the parasite, sometimes by the sustaining plant, or both. More often the form is that of a bell, of which the sucker corresponds to the tongue. Sometimes the tissue of the supporting plant rises round and embraces the sucker; and sometimes both plants furnish uniting growths round the point of attachment of the sucker. The author shows how the prehensive arrangement is more or less strong according to circumstances, and he gives histological details.—M. de Lesseps read a letter from M. Roudaire, giving news of boring operations in the region of the isthmus of Gabes, which are so far encouraging. One fact stated is that fresh water was found at 4 metres depth at the highest point; this would be important in the case of cutting through the tongue of land.—Observations on the project of forming an interior sea in Eastern Sahara, by MM. Martins and Desor. Having visited the region in 1863 they disapprove of the project, on the score of mirage possibly falsifying observations, the water of the new sea and any change of climate ruining the date palm cultivation, on which the natives so largely depend, &c.—Researches on the formation of latex and laticiferous vessels, during germinative evolution, in the embryo of *Tragopogon porrifolius*, by M. Faivre.—On the determination of imaginary roots of algebraic equations, by M. Farkas.—Remarks on differential linear equations and those of the third order, by M. Combescure.—On a simple way of presenting the theory of potential, and on the differentiation of integrals in cases where the function under the sign $\int$ becomes infinite, by M. Boussinesq.—Hydroelectricity and hydromagnetism; experimental results, by M. Bjerknes. These relate to actions of two pulsating or two oscillating bodies with each other, or a pulsating with an oscillating body. In one set of experiments air columns in two bell jars immersed in water, were varied through tubes, by means of pumps, causing pulsations.—On green and phosphorescent light from molecular shock, by Mr. Crookes.—On the dissociation of hydrate of chloral (new method) by MM. Engel and Moitessier. The dissociation is effected at about 61° in an atmosphere of chloroform. (A mixture of hydrate of chloral and chloroform is submitted to distillation.)—Researches on the yeast of beer, by MM. Schützenberger and Destrim. They compare the modifications of yeast in presence and absence of sugar. Simple digestion of yeast at 30° for twenty-four hours made it lose 1·77 per cent. of solid matter. With yeast and sugar there was an increase of solid matter; about 11·3 per cent. of yeast, or 5·7 per cent. of sugar.—On the homologues of oxyheptic acid, by M. Demarçay.—Analysis of a honey of Ethiopia, by M. Villiers. This honey, called *tazma*, is gathered (without wax) in subterranean cavities by an insect resembling a large mosquito. It differs from other honeys by absence of cane-sugar.—On the banana, by M. Corenwinder. He points out variations in its composition. In the fruit, sound and ripe, the total proportion of sugar may rise to 22·06 per cent.—On a process of enriching phosphates of carbonated gangue, by M. L'Hote. He effects decarbonatation of the phosphate, by heating it to near a cherry red, and making steam act on it. The quick lime is separated by means of weak hydrochloric acid.—On various epizooties of diphtheria of court-yard fowls at Marseilles, and on possible relations of this disease with human diphtheria, by M. Nicati. Inoculation of a rabbit succeeded; and the appearance of the disease in the fowls seemed to occur along with an increase of human diphtheria.—On the sensibility of the eye to action of coloured light more or less diluted with white light, and on photometry of colours, by M. Charpentin. The chromatic sensibility remained constant provided the white light added did not exceed a certain pretty high maximum (in the case of red, ten or twelve times the intensity of the red). A very simple element of comparison (of white and colourless lights) is had in determining for each light used, the minimum quantity capable of causing the original sensation of colourless light.—Researches on the physiological properties and the mode of elimination of methyl-sulphate of soda, by M. Rabuteau.—On sub-periostic ossification and especially on the mechanism of formation of Haversian systems in the periostic bones, by M. Laulanié.—Researches on the liver of cephalopod molluscs, by M. Jousset de Bellesme. The liver in these animals is not analogous in function to the liver of vertebrates. It is a digestive gland, merely transforming albuminoid matters, and without action on fatty or amylaceous matters.—Observations on a shower of sap, by M. Mussel. This was observed in autumn from the leaves of *Abies excelsa*.—The death of M. Gervais was announced.

GÖTTINGEN

Royal Academy of Sciences, December 7, 1878.—On the ponderomotor elementary law of electrodynamics, by Herr Riecke.—The mean depth of the ocean and the proportions of land and sea, by Dr. Krümmel.

January 4.—The meteorite collection of Göttingen University on January 2, 1879, by Herr Klein.—Electrolytic friction compared with capillary friction, by Herr Kohlrausch.

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